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10/521,575	07/20/2005	Sumio Iijima	2005_0065A	4026
513 7590 07/17/2008 WENDEROTH, LIND & PONACK, L.L.P. 2033 K STREET N. W. SUITE 800 WASHINGTON, DC 20006-1021				
EXAMINER KELLY, ROBERT M				
ART UNIT		PAPER NUMBER		
1633				
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

# Office Action Summary

**Application No.**

10/521,575

**Applicant(s)**

IIJIMA ET AL.

**Examiner**

ROBERT M. KELLY

**Art Unit**

1633

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 15 April 2008.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-6 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-6 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SF/ICE)  
Paper No(s)/Mail Date 4/15/08
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

Applicant's argument and response of 4/15/08 are entered.

No amendments were submitted.

Claims 1-6 are presently pending and considered.

### ***Information Disclosure Statement***

Applicant's IDS of 4/15/08 has been considered. It is noted that Applicant has now supplied the documents and translation copies of the documents. Hence, the IDS has been signed and initialed and accompanies the present Official Action.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

In light of Applicant's perfection of priority, the rejections of Claims 1-3 under 35 U.S.C. 102(a) as being anticipated by Yudasaka, et al. (2003) Chemical Physics Letters, 374(1-2): 132-36, are withdrawn.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

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(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

In light of Applicant's perfection of priority, the rejections of Claims 1-6 under 35 U.S.C. 103(a) as being unpatentable over Yudasaka, et al. (2003) Chemical Physics Letters, 374(1-2): 132-36, are withdrawn.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claims 1-6 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for methods of selectively lysing single-walled carbon nanotubes in solution, does not reasonably provide enablement for lysing multi-walled nanotubes. The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims.

Applicant's claims encompass the selective degradation of any form of nanotube, comprising exposing a composition containing carbon nanotubes with distinct structures to monochromatic light so as to selectively excite specific nanotubes and oxidizing those nanotubes in the presence of oxygen or an oxidizing agent.

The claims are broad, encompassing both single and multi-walled nanotubes.

However, while the Artisan would recognize that while crossing any particular band-gap energy would destabilize the molecule and increase the probability of destruction by an oxidizing

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agent, the Artisan would also understand that, in the case of multi-walled nanotubes, the tubes protect each other, prohibiting access to the oxygen/oxidizing agent. Hence, the Artisan would not reasonably predict that multi-walled carbon nanotubes could be selectively removed utilizing the method. Still further, performing such techniques with SWNTs in solids would similarly expect not to similarly vanish those SWNTs chosen, as the powder provides similar quenching. These predictions are also supported by the findings by Braidy that when exposed to white light under similar conditions, thick groupings of nanotube bundles and ropes are saved from destruction (Braid, et al. (2002) NanoLetters, 2(11): 1277-80), as well as by Ajayan, et al. (26 April 2002) Science, 296(5568): 705, demonstrating protection of some forms while in the powder form).

Therefore, the Artisan would have to experiment to find out if the protection provided by the multi-walled nanotube would preclude its selective destruction by the methods. Such is undue experimentation as it amounts to inventing the breadth of invention claimed for Applicant.

### **Ajayan-Based Rejections**

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1, 2, 4, and 6 are rejected under 35 U.S.C. 102(a) as being anticipated by Ajayan, et al. (26 April 2002) Science, 296(5568): 705.

Ajayan teaches the use of multiple sing-wavelengths of light to flash-ignite compositions comprising many different nanotubes in experiments carried out at room temperature with oxygen in the atmosphere (Article in general). Such yields specific nanotube structures left over (e.g., FIGURES).

Hence, Ajayan teaches claimed embodiments.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 2, 3, 4, and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ajayan, et al. (26 April 2002) Science, 296(5568): 705 and Huang, et al. (February 2002) Chemosphere, 46(6): 815-825, e.g., ABSTRACT.

Ajayan, as shown above, teaches various embodiments of the claimed invention, and therefore, also makes those same embodiments obvious. However, Ajayan does not teach the use of potassium permanganate.

On the other hand, the Artisan is well aware that potassium permanganate is an oxidizing agent, and that such could be utilized instead of oxygen as the oxidizing agent to flash-burn these same nanotubes. For example, Huang teaches the use of potassium permanganate in similar redox reactions (e.g., ABSTRACT).

Hence, because of the similar function of potassium permanganate in chemical reactions (general oxidizing agent), it would have been obvious to replace the use of oxygen with potassium permanganate. The Artisan would have had a reasonable expectation of success, as potassium permanganate was well known to have such similar function.

### **Braidy-Based Rejections**

#### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

Claims 1, 2, 4, and 6 are rejected under 35 U.S.C. 102(a) as being anticipated by Braidy, et al. (November 2002) Nano Letters, 2(11): 1277-80.

Braidy teaches flash-ignition of raw carbon nanotubes in solution (e.g., p. 1278), which yields nanotube bundles (e.g., FIGURE 5). Moreover, these experiments were carried out at room temperature and in the presence of oxygen, absent reason to believe otherwise.

Hence, Braidy teaches embodiments encompassed by the claims.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Braidy, et al. (November 2002) Nano Letters, 2(11): 1277-80 and Huang, et al. (February 2002) Chemosphere, 46(6): 815-825.

As shown above, Braidy teaches specific embodiments encompassed by the claims, and hence, also makes obvious those embodiments. However, Braidy does not teach the aspects of utilizing potassium permanganate or the successive exposure to different wavelengths of light.

However, with regard to the use of potassium permanganate, it would be obvious to utilize such, as it would supply the oxidizer in a similar manner to oxygen, and such salt is well known as an oxidizing agent in reactions. For example, Huang teaches the use of potassium permanganate in similar redox reactions (e.g., ABSTRACT).

With regard to the successive exposure to light of different wavelengths, Braidy teaches that the intensity dependence and wavelength dependence of the photolysis of such molecules are the focus of future investigations (e.g., pp. 1279-80, paragraph bridging).

Hence, at the time of invention, the Artisan would have found it obvious to utilize potassium permanganate, as it provides the same function in similar reactions, and further to utilize single or successive distinct wavelengths of light, at various intensities, to learn the wavelength dependence and intensity dependence of the reactions. Moreover, the Artisan would expect success as we know the light to already photocatalyze the reaction, and the potassium permanganate to provide similar function as oxygen.

#### **General Art-Based Rejections**



***Claim Rejections - 35 USC § 103***

Claims 1-6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kataura, et al. (1999) Synthetic Metals, 103: 255-88, Wintmere, et al. (1995) Carbon, 33(7): 893-902, U.S. Patent No. 5,294,315 to Cooper, U.S. Patent No. 5,116,582 to Cooper, U.S. Patent No. 5,174,877 to Cooper, and Huang, et al. (February 2002) Chemosphere, 46(6): 815-25.

Kataura teaches that SWNTs in solution have distinct absorption peaks, correlating to their diameters (e.g., ABSTRACT). Further, such specific band-gap differences are to be expected as shown by Wintmire (e.g., ABSTRACT and SUMMARY).

It is well known that such band-gaps can be utilized to excite electrons into less stable states, and in fact that is what occurs during the absorption of light, as seen in Kataura.

Hence, given this, the Artisan at the time of invention recognized that specific SWNTs could be targeted by the utilization of single-wavelength light to excite electrons into more unstable states.

In fact the Artisan recognized that such absorption could be utilized to completely release electrons from a molecule and may be utilized to cause photolysis of those molecules with that band-gap energy (e.g., U.S. Patent No. 5,294,315 to Cooper, et al., BACKGROUND, paragraph 4; U.S. Patent No. 5,116,582 to Cooper, et al., DESCRIPTION OF THE PRIOR ART, paragraph 1). Still further, the use of any oxidizing agent is readily apparent to the Artisan, including the use of hydrogen peroxide (e.g., U.S. Patent No. 5,174,877 to Cooper, et al., DESCRIPTION OF THE PRIOR ART, paragraph 5, teaching the general use of any oxidizer; and Huang, et al. (February 2002) Chemosphere, 46(6): 815-825, e.g., ABSTRACT, teaching the use of potassium permanganate).

Hence, at the time of invention, it would have been obvious to utilize the well-known band-gap energy differences to excite electrons in specific SWNTs in solution and do to yield selective degradation of those SWNTs which are not desired. Moreover, the Artisan would be motivated to do so either exposure to all the wavelengths except those desired, either serially or at one single time, to yield only those SWNTs desired, as each method would be instantly recognized to suffice. Finally, the Artisan would expect success, as the band-gap energies were known to differ, the methods of photolysis were known, and the use of potassium permanganate in redox reactions was well known.

### ***Conclusion***

No claim is allowed.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **ROBERT M. KELLY** whose telephone number is (571)272-0729. The examiner can normally be reached on M-F, 9:00am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Joseph Woitach can be reached on (571) 272-0739. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Robert M Kelly/  
Examiner of Art Unit 1633